

SOUTH DAKOTA

# GAME, FISH and PARKS

Zebra Mussels In South Dakota

Mike Greiner, AIS Coordinator

# Outline

- Zebra mussel biology and impacts
- Discovery and response in Lake Sharpe
- Current GFP program
- How you can help


Photo credit: Cindy Sawchuck


# Dreissenid Mussels

## Zebra Mussel (*Dreissena polymorpha)*

www.epa.gov

## Quagga Mussel (*Dreissena rostriformis bugensis)*

# Physical Characteristics

## Zebra Mussel

- Shape:
  - Triangular or “D” shaped
  - Sharply pointed hinge
- Color
  - Alternating dark (green to brown) and light (white to yellow) bands
- Size
  - 3-5 cm

## Quagga Mussel

- Shape:
  - Fan-Shaped
  - Rounded hinge
- Color:
  - Brown to white, stripes may or may not be present
- Size:
  - Up to 4 cm

www.epa.gov

# How did they get here?

- Introduced to the U.S. in 1980's in ballast water
- Spread throughout Great Lakes via drift and boats
- Spread throughout Mississippi River drainage
  - MO, AR, TN, OH Rivers
- Overland transport spread to inland lakes

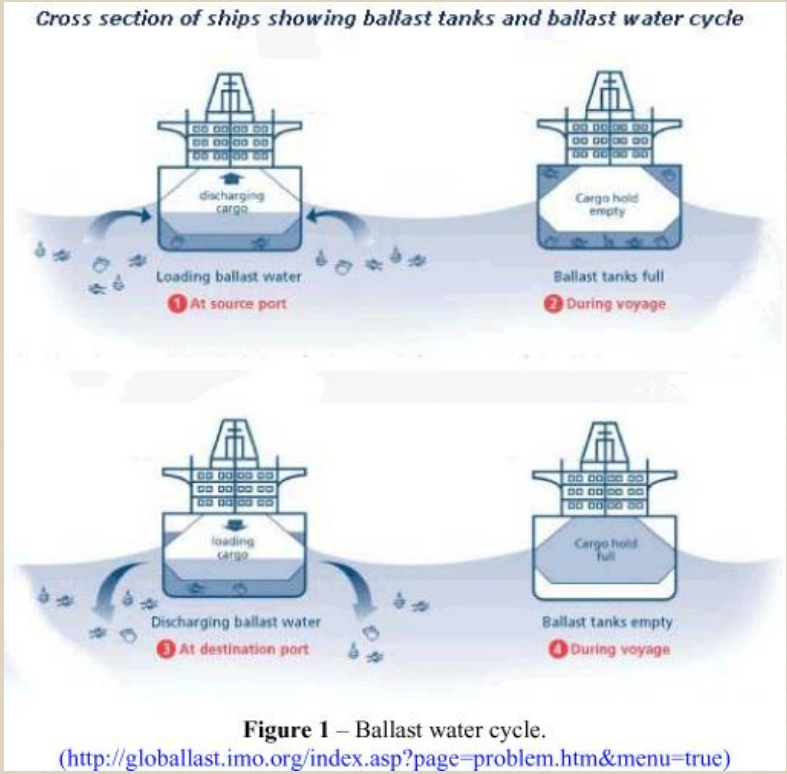
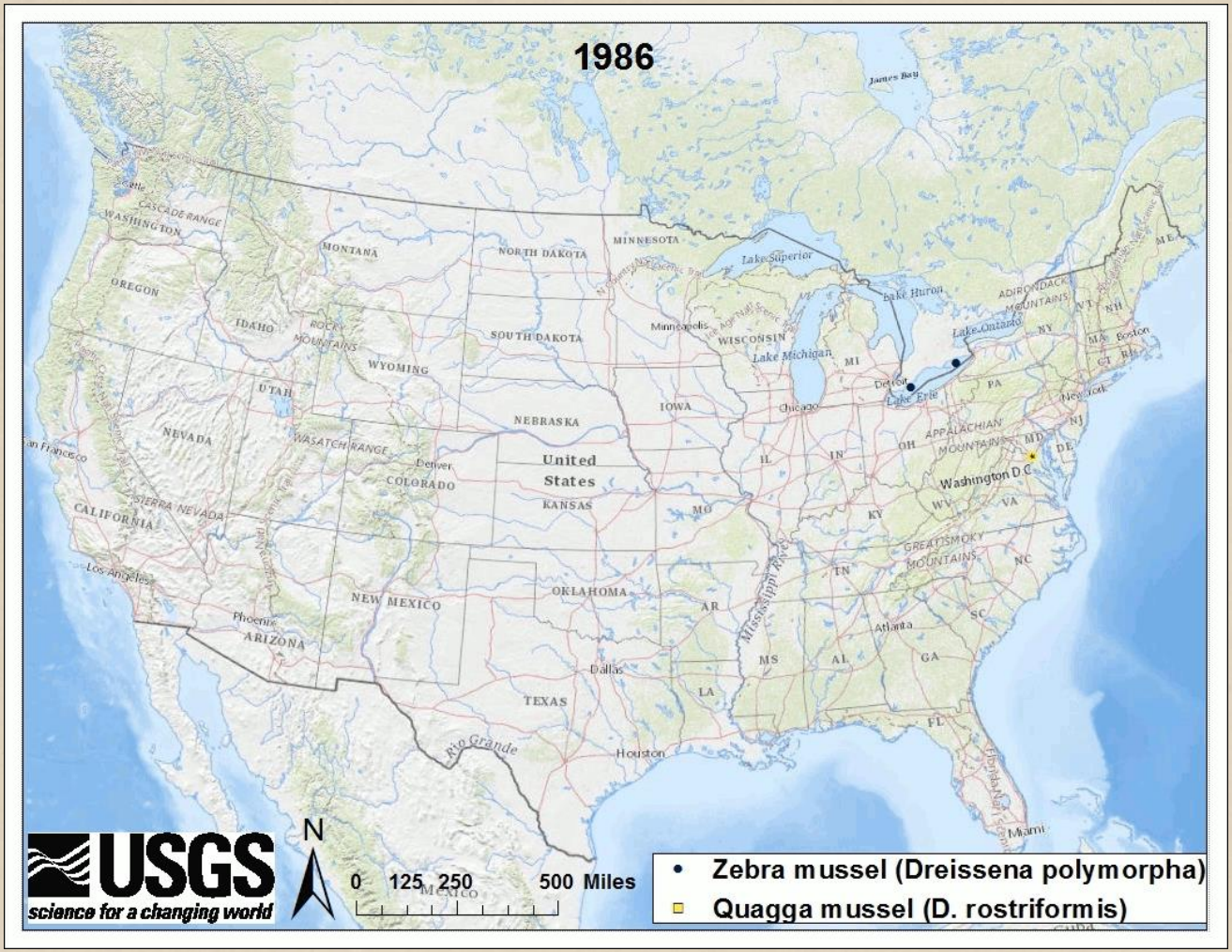



**Figure 1** – Ballast water cycle.
(http://globallast.imo.org/index.asp?page=problem.htm&menu=true)

# How have they spread?



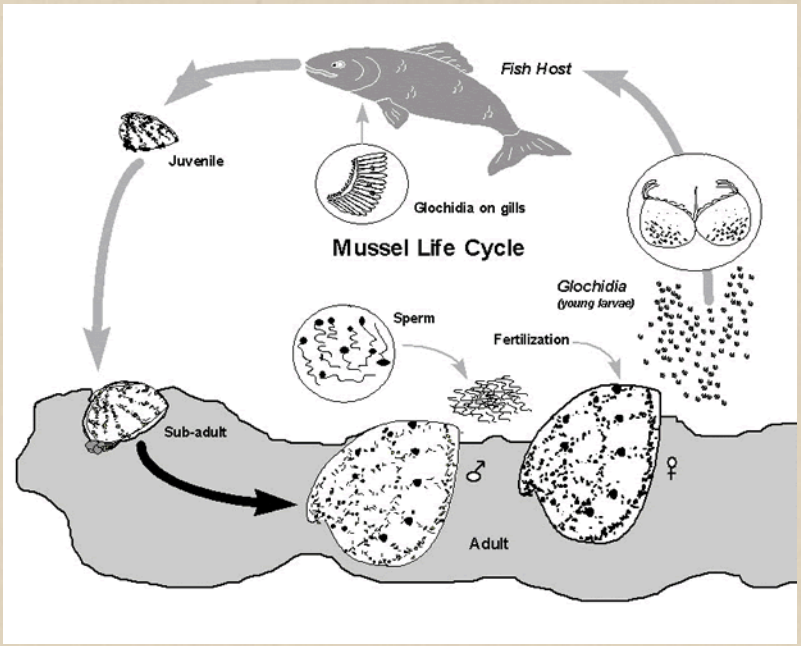
# Successful Invaders, Why?

- Prolific
  - Females produce up to 1 million eggs/yr
  - Densities up to 700,000/$m^2$
  - Can completely clog water pipes
- Efficient
  - Each individual can filter 1L of $H_2O$/day
  - Lake Erie-100% increase in water clarity
- Resilient
  - Survival: below freezing to 90°F
  - Avoid chemical treatment by closing shells
  - Can survive up to 30 days out of water

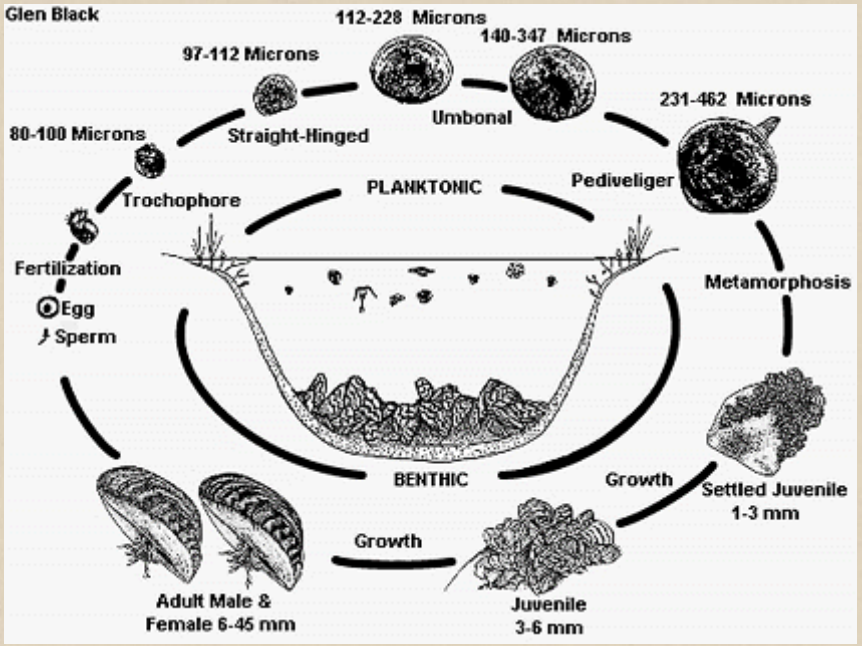
# Byssal threads

- Proteinacious threads act like cement
- Allow Dreissenids to attach to hard surfaces or macrophytes
- Quagga mussels can also attach to soft surfaces such as mud

# Mussel Life Cycles




Native Freshwater Mussel




Dreissenid Mussels

# Veligers

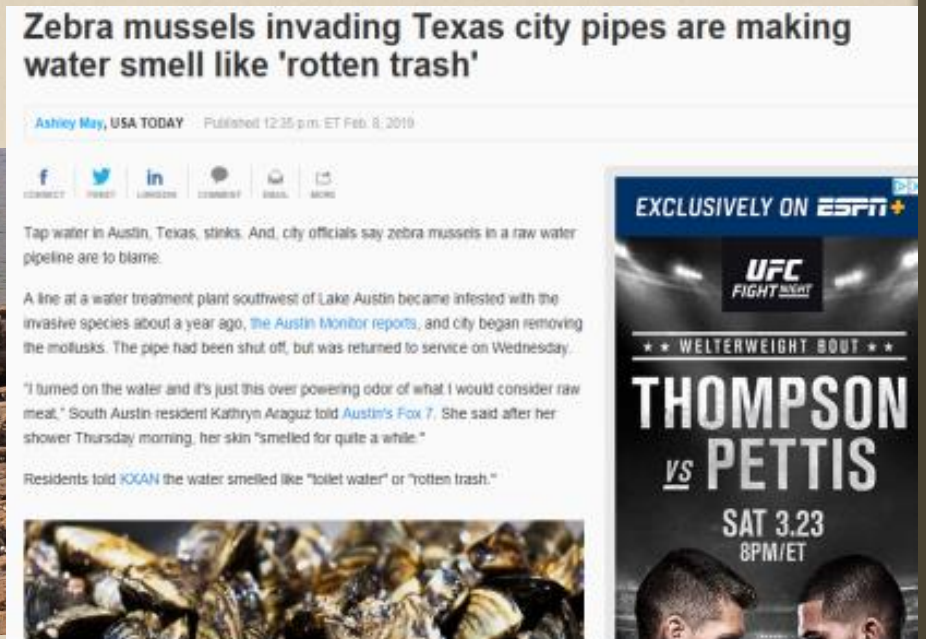
- Spawning begins at 55°F and maxes at 62.6°F
- Larval stage (68-71.6°F optimal)
  - Do not require host
  - Free swimming up to a month
  - Can go 2 weeks without food
  - Smaller than human hair
    - 70-200 microns
  - Settle out and crawl via foot seeking hard substrate or vegetation

# Zebra Mussel Impacts

# Environmental effects

- Filter up to L $H_2O$/mussel/d
- Pseudofeces can concentrate heavy metals, PCBs
- Razor sharp shells cover shorelines

- Prefer green algae, increasing amount of blue-green algae in systems
- Foul taste, smell of drinking water



**Zebra mussels invading Texas city pipes are making water smell like 'rotten trash'**

Ashley May, USA TODAY · Published 12:35 p.m. ET Feb. 8, 2019

Tap water in Austin, Texas, stinks. And, city officials say zebra mussels in a raw water pipeline are to blame.

A line at a water treatment plant southwest of Lake Austin became infested with the invasive species about a year ago, the Austin Monitor reports, and city began removing the mollusks. The pipe had been shut off, but was returned to service on Wednesday.

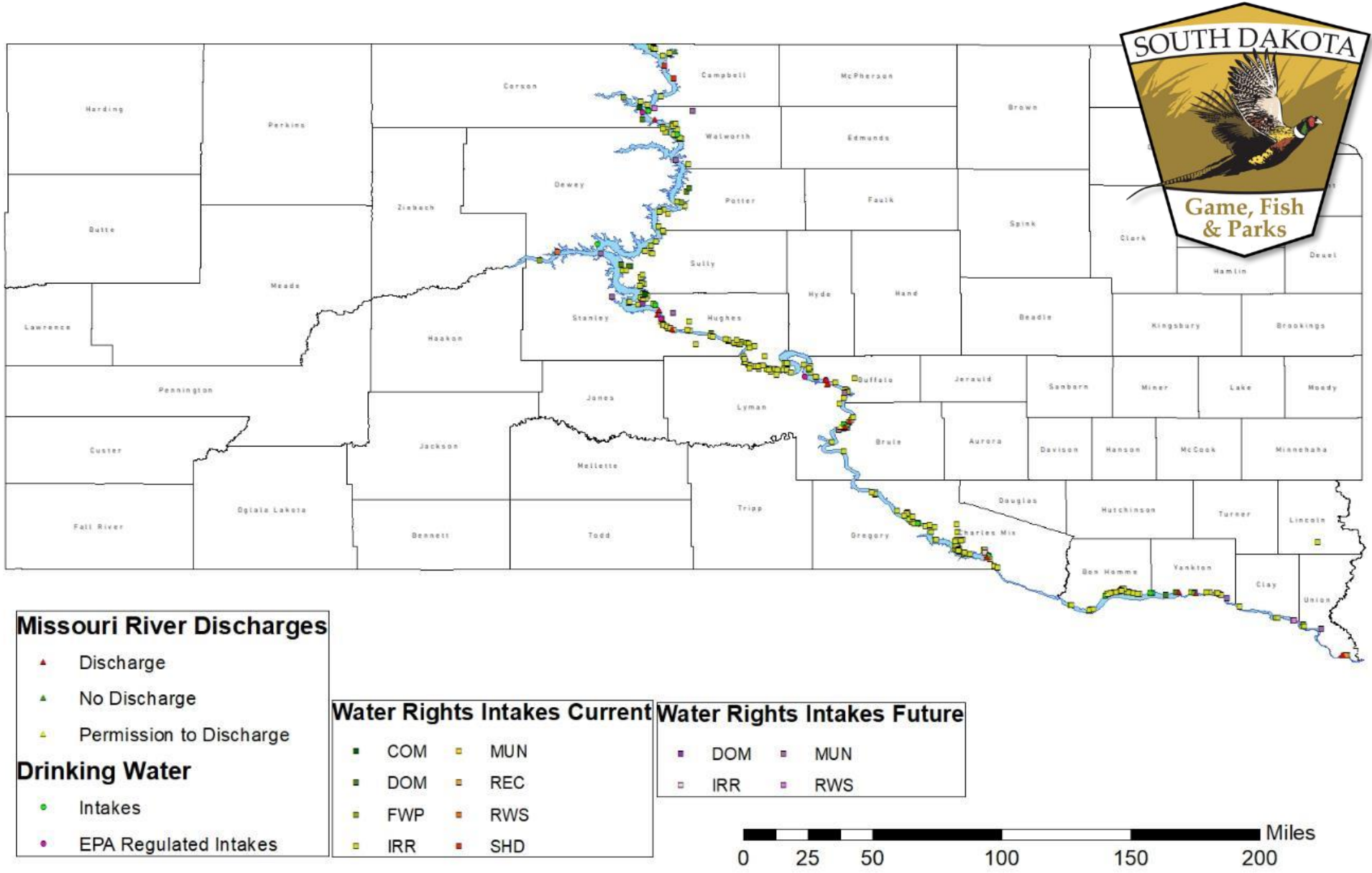
"I turned on the water and it's just this over powering odor of what I would consider raw meat," South Austin resident Kathryn Araguz told Austin's Fox 7. She said after her shower Thursday morning, her skin "smelled for quite a while."

Residents told KXAN the water smelled like "toilet water" or "rotten trash."

# Infrastructure effects

- Power production, drinking water, irrigation
- Costly Mitigation
  - National cost of $1B annually (Pimentel et al. 2004)
- Eradication is generally infeasible
  - Infestations are not typically discovered until the population is well-established
  - Need appropriate concentration and contact time

Photo credit: Heidi McMaster




# Missouri River Water Intakes

# Mitigation options

- Intakes
  - Replace intake screens with mussel resistant material or use anti-fouling coatings
  - Periodic inspection and mechanical removal

- Pipes
  - Water jetting
  - Chemical treatments injected into intake pipes
    - Chlorine, Bromine, Sodium Permanganate, Copper biocides, Copper ionization
    - Permits needed

- Inside facilities
  - Sand and drum filters
  - UV light + strainers

❖ Various levels of cost and down time

# Examples from Mussel Summit

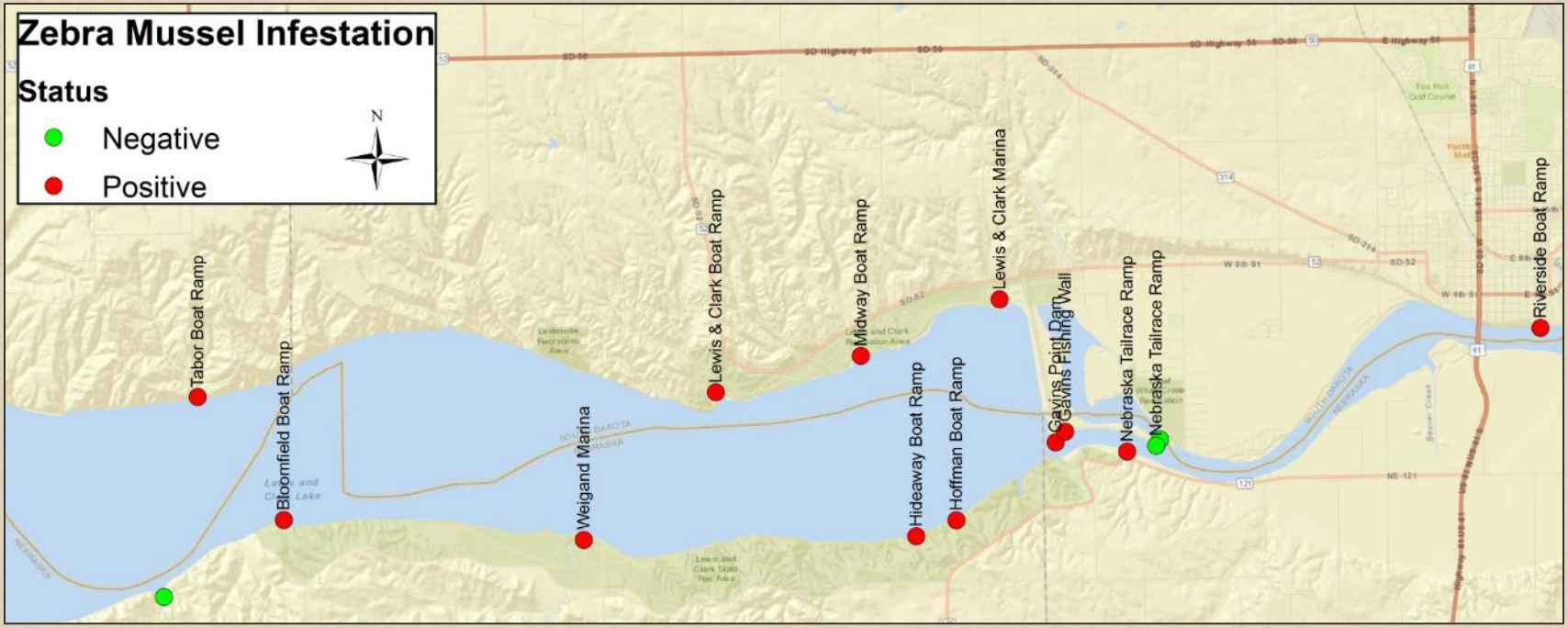
- Bon Homme-Yankton rural water- $1,340,000
  - Copper ionization and copper-nickel alloy intake screens deemed best option
- Milford, IA municipal utilities- $1,300,280
  - Larger intake pipe, copper intake screens, chemical feed lines to inject copper ion solution, Hydroburst to clean intake screens
- Spirit Lake, IA DNR hatchery - $1,654,000
  - Oxidizing chemicals not allowed due to toxicity to fish
  - Copper intake screen, drum screens as physical barrier, UV disinfection
- Gavins Point Dam- $2,730,800
  - New strainers + UV light

# Lewis & Clark Lake Zebra Mussels

- Nov. 2014—Single Adult
- June 2015—Positive Veliger Sample
- Aug. 2015—Widespread Adult Infestation
- Aug. 2016 to present—Exponential Growth in Adults

# 2015 Lewis & Clark Snorkel Survey

- $\approx 1/3$ of Marina boats had at least one mussel attached
- All dock structures were infested
- Subsequent sampling has shown a large geographic range



# 2016 Lewis & Clark Snorkel Survey

- 85% of all boats with mussels, nearly all very heavily
- Of the 15% w/o mussels, all on lifts

# 2017-2018 Settlement Surveys

- 2017
  - 33,000 ZM/m² average density
  - Range: 18,000- 49,000/m²
- 2018
  - 36,000 ZM/m² average density
  - Range: 25,000- 147,000/m²
  - Moved up to delta

# AIS Prevention (Watercraft Inspection)

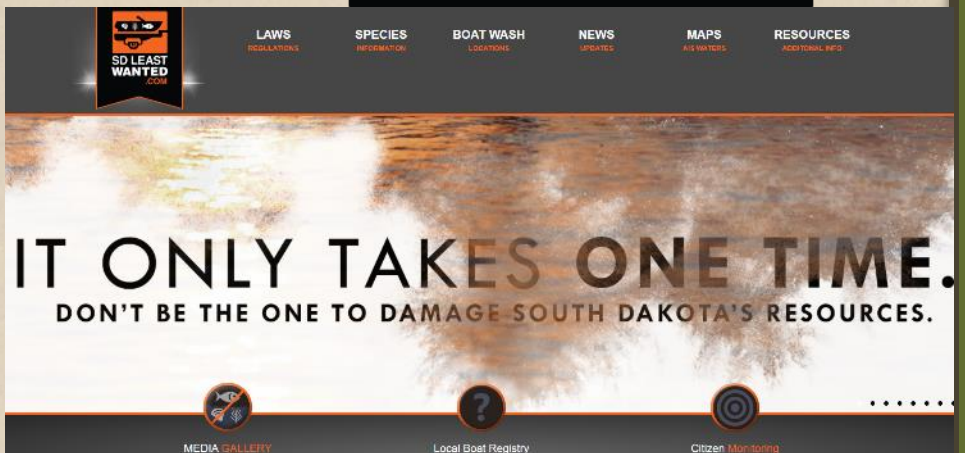
- Lake specific & border stations not feasible at this time.
- Roving Inspections
  - May through August
  - Six two-person teams equipped with decontamination units
- Primary goal of intercepting infested watercraft before launch
- Secondary goal is to educate boaters on self- inspection and to increase compliance with existing regulations

# Why Inspect Boats?

- Inspections can prevent introductions into new waters.

# AIS Prevention (Education & Outreach)

- **SD Least Wanted Campaign**
- Boat ramp signs
- Digital and social media marketing
- Education events
- “Swag” items (shirts, stickers, etc.)
- Fishing and Boating Handbook

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# Zebra Mussels in Lake Sharpe

- Actions taken
- Future actions under consideration

Pipe at Gavins Point Dam

Shoreline in Yankton

# Initial Discovery

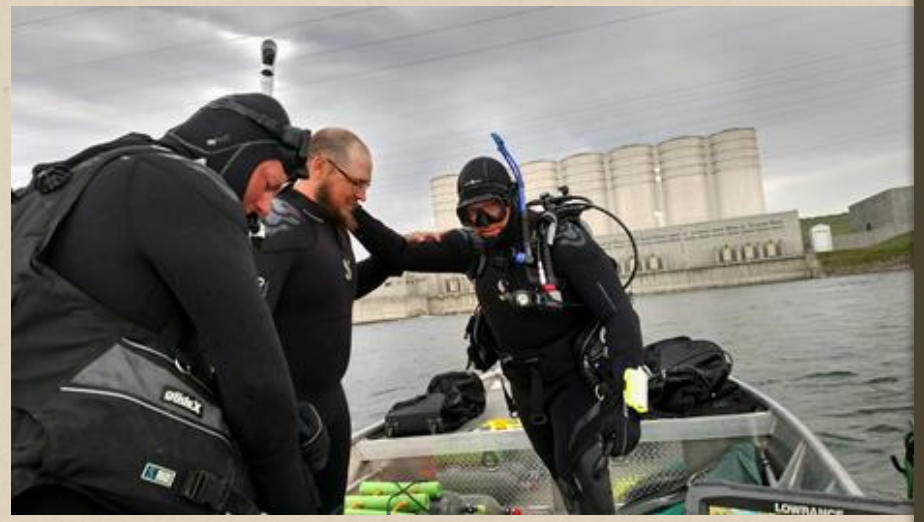
- July 10, 2019
  - USACE discovered adult zebra mussels during maintenance at Big Bend Dam

- July 11, 2019
  - USFWS to inspect shoreline at ramps and GFP Hester-Dendy samplers attached to docks
  - GFP SCUBA team dove on Lakes Sharpe and Francis Case
  - Zebra mussels present inside dam pit/gate area

# Sampler and Shoreline Results

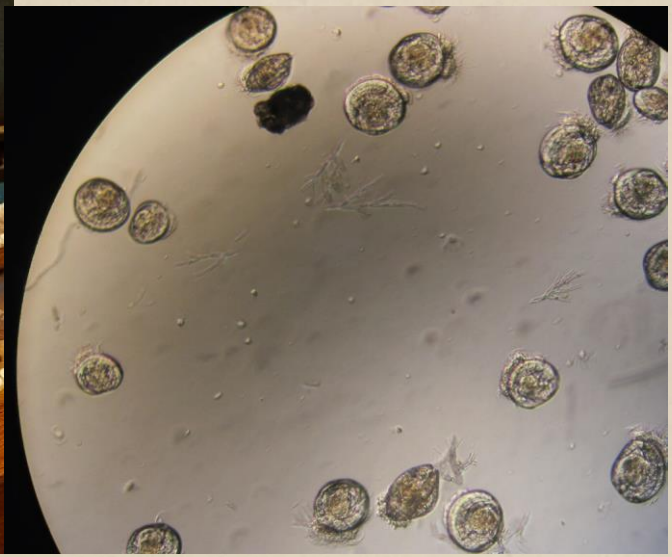
# GFP SCUBA Surveys

- BBD stilling basin
- Francis Case
- Oahe tailrace
- Oahe dam and intake pillars
- Spring Creek Marina



# Other Monitoring

- Veligers
- Settlement Samplers



# Watercraft Inspection and Decontamination

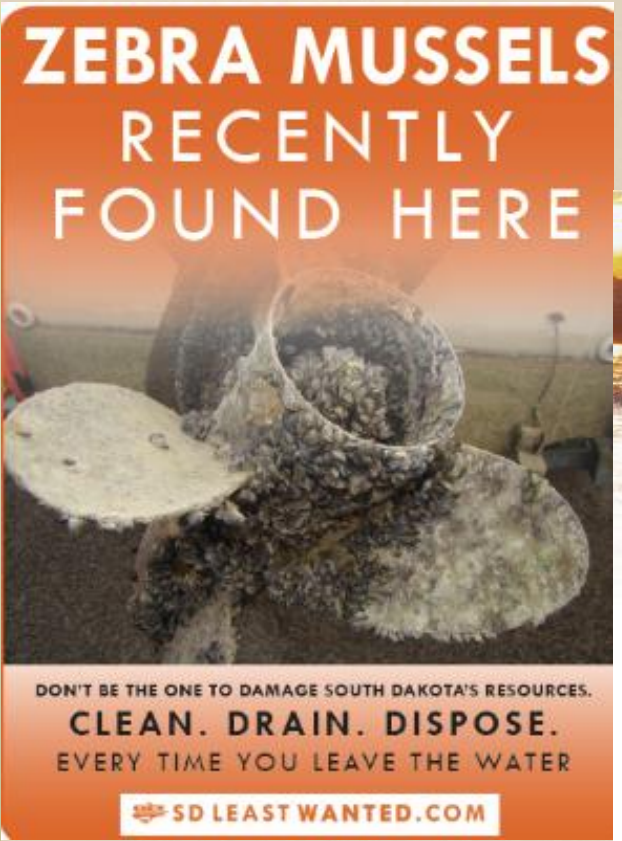
- Law enforcement special details
- Boat ramp saturation
- 30 permanent staff trained in watercraft inspection and decontamination
- Met with Lake Sharpe and Francis Case marina operators and boat repair shops

# Communications Actions

- Geofencing on Lake Sharpe, social media posts, GFP podcast, sharing Governor Noem's PSA on social media and websites, Plug In/Plug Out video
- Zebra mussel displays, outreach materials, AIS "swag" items sent to state fair
- 3'x5' banners created for
  Labor Day weekend
- DOT message boards
  - Pickstown, Chamberlain

# Updated Messaging

- “Newly Infested” signs placed at ramps around Lake Sharpe, began updating other signage and outreach materials







# Commission Actions

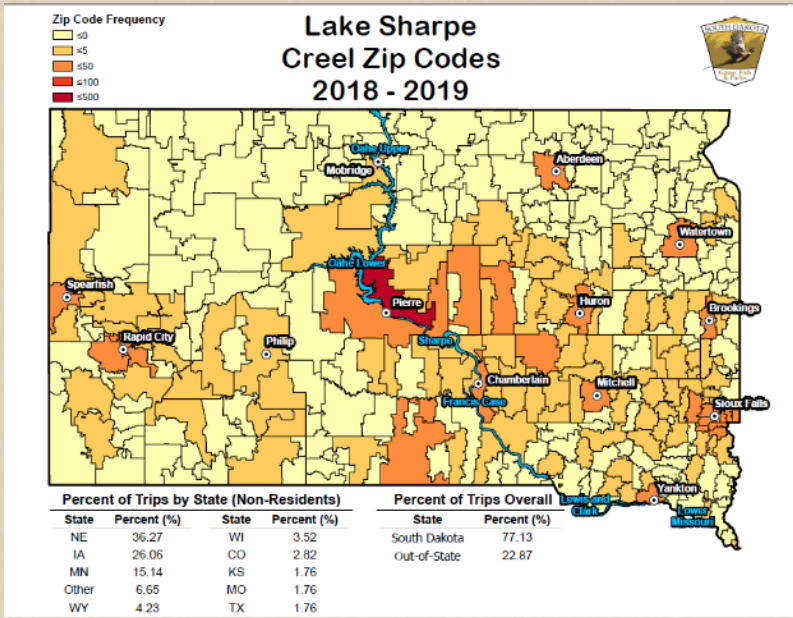
- Special Commission Meeting
- Sharpe and Francis Case designated containment waters on emergency basis
- Letter to Governor Noem
- Approved September proposals, rule finalization next month

# Building partnerships

- Discussed response options for SD, funding opportunities, experiences/lessons learned in other states with national work groups
- State Agency work group formed - DENR, DOA, DOT, DTR
- Prepared management options briefing for Governor Noem

# What's different about Sharpe and Francis Case?

- Boaters from entire state

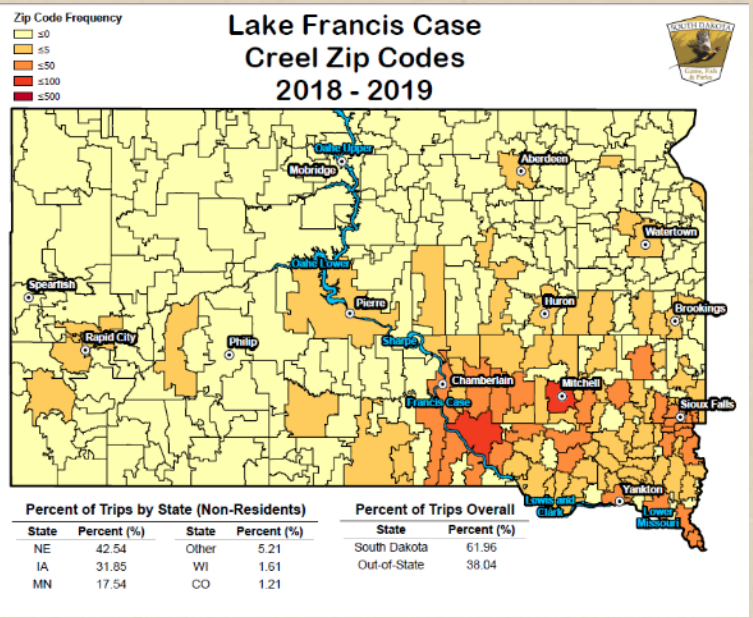



Percent of Trips by State (Non-Residents)

| State | Percent (%) | State | Percent (%) |
|---|---|---|---|
| NE | 36.27 | WI | 3.52 |
| IA | 26.06 | CO | 2.82 |
| MN | 15.14 | KS | 1.76 |
| Other | 6.65 | MO | 1.76 |
| WY | 4.23 | TX | 1.76 |

Percent of Trips Overall

| State | Percent (%) |
|---|---|
| South Dakota | 77.13 |
| Out-of-State | 22.87 |




Percent of Trips by State (Non-Residents)

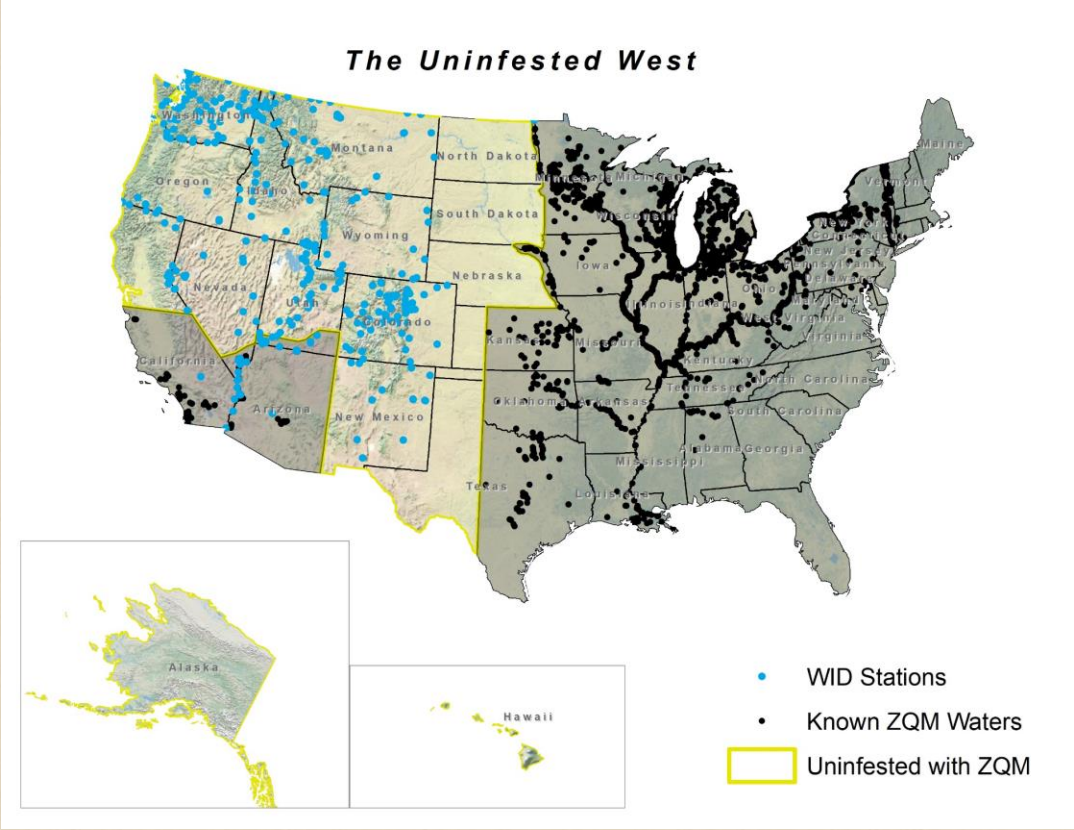
| State | Percent (%) | State | Percent (%) |
|---|---|---|---|
| NE | 42.54 | Other | 5.21 |
| IA | 31.85 | WI | 1.61 |
| MN | 17.54 | CO | 1.21 |

Percent of Trips Overall

| State | Percent (%) |
|---|---|
| South Dakota | 61.96 |
| Out-of-State | 38.04 |

# Watercraft Inspection and Decontamination (WID) Programs

- Border checks, ramp closures, mandatory WID, impound authority, seal and receipt programs, lots of $$$



# Is a western style WID program appropriate for SD?

- Authorities we don't currently have (mandatory, impound, seal and receipt)
- Inspectors at all ramps not feasible
  - Over 400 FTE's and $8.4M for MO River alone
  - Would need to close ramps when inspectors not present

**All estimates of cost include overtime**

| Lake | No. Ramps | Seasonal FTEs Required | Paid WID Hours/Week | Total WID Hrs Paid | Decon Units | Per Diem | Wages | Total Cost Estimate |
|---|---|---|---|---|---|---|---|---|
| Sharpe | 22 | 88 | 4,708 | 122,408 | $264,000 | $272,272 | $1,299,973 | $1,836,245 |
| Francis Case | 28 | 112 | 5,992 | 155,792 | $336,000 | $346,528 | $1,654,511 | $2,337,039 |
| Lewis and Clark | 12 | 48 | 2,568 | 66,768 | $144,000 | $148,512 | $709,076 | $1,001,588 |
| Oahe | 39 | 156 | 8,346 | 216,996 | $468,000 | $482,664 | $2,304,498 | $3,255,162 |
| **Total** | **101** | **404** | **21,614** | **561,964** | **$1,212,000** | **$1,249,976** | **$5,968,058** | **$8,430,034** |

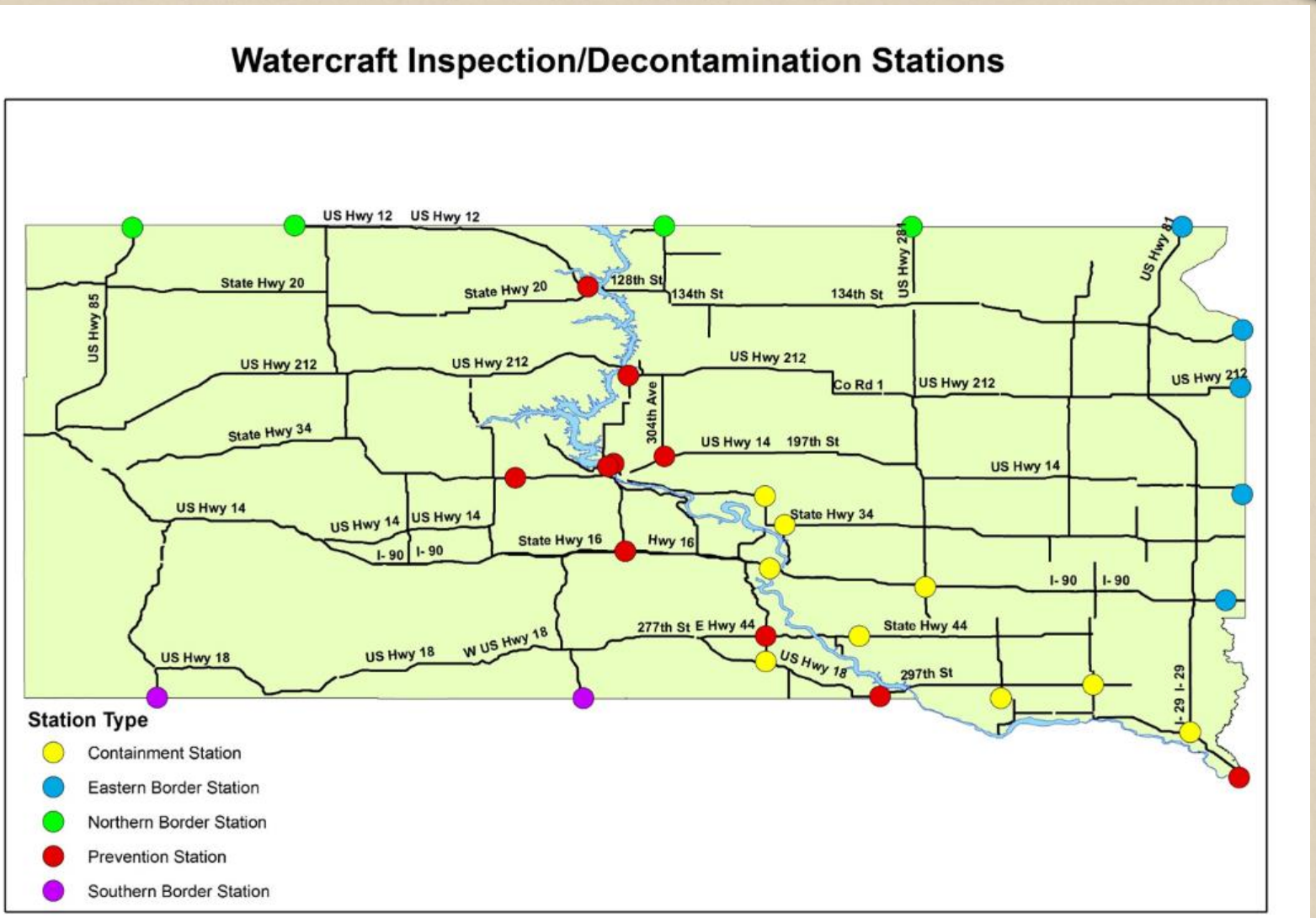
# What is possible in SD?

- Containment – exit inspections, focused on decontamination of boats leaving
- Prevention – entrance inspections
- Border stations – lowest priority at this time

Table 1. Cost estimates for watercraft inspection and decontamination stations.

| Type | No. Stations | Seasonal FTEs Required | Paid WID Hours/Week | Total WID Hours Paid | Decon Units | Wages and Per Diem | Total Cost Estimate |
|---|---|---|---|---|---|---|---|
| Containment | 9 | 36 | 1,926 | 50,076 | $108,000 | $643,191 | $751,191 |
| Prevention | 10 | 40 | 2,140 | 55,640 | $120,000 | $714,657 | $834,657 |
| Eastern Border | 5 | 20 | 1,070 | 27,820 | $60,000 | $357,328 | $417,328 |
| Northern Border | 4 | 16 | 856 | 22,256 | $48,000 | $285,863 | $333,863 |
| Southern Border | 2 | 8 | 428 | 11,128 | $24,000 | $142,931 | $166,931 |
| Roving | 5 | 20 | 1,070 | 27,820 | $60,000 | $357,328 | $417,328 |
| Total | 35 | 140 | 7,490 | 194,740 | $420,000 | $2,501,298 | $2,921,299 |

# What might this look like?



# Field Results

- 17 law enforcement details
  - 818 boats checked
  - 104 citations
  - 8 warnings
- 994 Watercraft inspections
  - 3 decontaminations performed

- ZM as far up as West Bend in Lake Sharpe
- <u>ZM not yet documented in Francis Case or Oahe</u>
- Over 4.4 million impressions from digital marketing efforts

# Planning for the next 12-18 months

- Evaluate options for securing authorities for inspections and decontamination, funding sources, and consistent enforcement
- Identify priority waters based on water chemistry, boater use
- Expand citizen science monitoring and outreach
- Meet with/define other agency contributions

# Take Home

- Still in early stage of infestation
- Continue surveys to determine extent of distribution in Sharpe and if Francis Case is infested
- Regulations are in place to minimize transport of water
- Surface water infrastructure likely will be more impacted than fisheries

# Take Home

- Discovery of zebra mussels in Lake Sharpe is a game changer - Sharpe and Case are destination lakes, utilized by anglers and boaters from throughout South Dakota

- Changes to South Dakota's management approach will occur before next year's boating and construction season
  - Additional inspection, decontamination and impoundment authorities
  - Additional funding sources
  - Identifying how various governmental and nongovernmental entities can aid in AIS management efforts

# What can you do?

- Self-inspect every time
- Clean, Drain, Dry
- Implement BMP's on all projects
  - Communicate with GFP on planned projects to inspect boats, barges, equipment
- Outreach
  - Funding support and/or distribution of materials

# Where are they likely to be?


- Rough areas, right angles
- Dark surfaces
- Shaded areas
- Below water line
- In compartments

- *GFP believes a statewide, coordinated approach, involving active participation by all entities that can help work towards meeting AIS management objectives, is essential for the effective management and control of AIS in South Dakota. The use of resources and regulations to manage AIS should be balanced with their potential effectiveness at slowing or preventing the spread of AIS.*

- Involvement of all entities who use surface water in SD is essential for any management approach to succeed

- Tell us how to best engage your (association, council, township, county, department, business, organization, etc.) so we can partner on AIS management


SOUTH DAKOTA
Game, Fish
& Parks